The impact of international diversification on credit scores: Evidence from the UK

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Abstract

Despite the great deal of previous research into international diversification, we know little about the impact of international diversification on firms' credit scores. Drawing upon the resource-based view and transaction cost economics, we examine the relationship between international diversification and credit scores by using a large sample of 6,557 UK firms between 2016 and 2017. We find an inverted U-shaped relationship between international diversification and firms' credit scores, indicating that the effect of international diversification on credit scores is initially positive but becomes negative with over-diversification. In addition, we find that R&D intensity positively moderates the relationship between international diversification and credit score, implying that the credit scores of highly diversified firms improve as they increase their investment in R&D. Further analysis suggests that a firm's credit score becomes less dependent on international diversification for large firms, firms in concentrated industries, firms in the manufacturing sector, and firms distant from key metropolitan areas, such as London.

Keywords: *International diversification, credit score, innovation, competition, exporting firm, SMEs*

"There are opportunities all over the world for ambitious businesses. If you are looking to build your business at a faster rate, then it is worth seriously considering the benefits exporting can bring" – Matt Legon, Gnaw Chocolate's Founder.

1 Introduction

An increasing number of British firms have internationalised their business activities in recent years. According to a report published by the Office for National Statistics (ONS), the number of small and medium-sized enterprises (SMEs) exporting abroad increased in 2017 by almost 10% on the previous year, while the number of large firms exporting abroad increased by around 42% (DIT, 2018). This provides vindication of firms' understanding/awareness of the (direct and indirect) benefits of diversifying the geographical scope of their sales and operations. This is in part due to the work being done by the government and industry in raising awareness of the opportunities in international trade, as well as the increasing attention that international diversification has received in academic and policy debates[1]. As a UK Trade & Investment (UKTI) report suggests, UK firms exporting abroad not only increase their levels of turnover and profitability but are also 11% more likely to survive than those that are purely domestic (UKTI, 2012).[2] Existing research also provides evidence that international diversification is a growth strategy open to both large firms and SMEs and is deemed beneficial to firms through the exploitation of global market opportunities and imperfections (Jong & van Houten, 2014; Rugman, 1979). For instance, many studies in international business (e.g., Almodóvar, 2012; Benito-Osorio, Colino, Guerras-Martín, & Zúñiga-Vicente, 2016; Boehe & Jiménez, 2016; Brock, Yaffe, & Dembovsky, 2006; Lee, 2010; Pisani, Garcia-Bernardo, & Heemskerk, 2020) have shown notable effects of internalisation on firm performance (e.g., linear, curvilinear, and threshold relationships).

Despite the wealth of empirical studies on the net performance benefits of international diversification, we still know relatively little about its effects on firm risk and hence creditworthiness, so further research on the relationship between international diversification and firms' credit scores[3] is warranted. On the one hand, it has been suggested that diversification offsets risks (Kim, Hwang, & Burgers, 1993) and increases a firm's market power (Kogut, 1985); on the other hand, it has been linked to managerial empire-building and inefficiency (Jiraporn, Kim, Davidson, & Singh, 2006; Prezas, 2009).

In this paper, we argue that international diversification not only brings benefits but also comes with costs and risks, with the net benefits depending on these aspects combined. In other words, international diversification is a coin with two sides: benefits and costs/risks. An analysis that ignores either side of

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[1] Internationalisation and international diversification are both used in this paper interchangeably to mention to the expansion of the firms across national borders through their foreign sales.

[2] UK Trade and Investment (UKTI) has been replaced by Department for International Trade (DIT) since July 2016.

[3] In this study, we use the credit scores available on the FAME database to capture firm failure risk. More specifically, these credit scores capture the likelihood of a business becoming insolvent over a period of 12 months, ranging from 0 to 100, with lower scores indicating a greater probability of default risk.

this coin is an incomplete analysis. That is, the advantages of international diversification are not limitless, as beyond a certain level of diversification, the costs/risks will outweigh the potential benefits, thus decreasing the net benefits that multinationality brings (Hitt, Hoskisson, & Kim, 1997). The resource-based view (RBV) highlights the positive effects of international diversification through using internal resources and capabilities to exploit global markets' imperfections and opportunities (Barney, 1991), thus achieving economies of scale, scope, and learning. With higher levels of diversification, transaction cost economics (TCE) predicts that firms will experience increasing costs offsetting the benefits achieved (Hitt et al., 1997; Kotabe, Srinivasan, & Aulakh, 2002; Batsakis & Mohr, 2017). However, firms with unique internal capabilities and resources, such as investment in R&D, will achieve differential benefits from international diversification.

We combine the RBV and TCE to investigate the effects of international diversification on firms' credit scores. Specifically, we address two key interrelated research questions: (1) Does an increase in international diversification enhance firms' credit scores? and (2) What is the role of R&D intensity in moderating the relationship between international diversification and firms' credit scores? We argue that the benefits, costs, and risks are the three channels through which international diversification influences credit scores. We use the RBV logic to explain the benefits of international diversification and the moderating impact of R&D intensity, and we use TCE to explain the increasing environmentally associated costs/risks that come with over-diversification. Credit scoring assumes particular salience here, in that it reflects external assessments of the worth of an organization and its potential (Berg, Burg, Gombović, & Puri, 2020), and, as such, may place assessments of the impact of transaction costs on a more equal footing with perceptions of resource endowments.

Using a large sample of 6,557 UK firms, first, we find an inverted U-shaped relationship between international diversification and credit scores. That is, firms benefit from low and moderate levels of international diversification; however, the increasing transaction costs and risks resulting from intensive international diversification have a negative impact on firms' credit scores. This might indicate that credit raters are effectively factoring in the risks that come with over-diversification. Second, we document that the negative impact of high international diversification on credit scores, however, decreases for innovative firms, indicating a positive moderating impact of innovation on the relationship between international diversification and credit scores. This would suggest that firms' spending on innovation seems to make for more-optimistic creditor sentiments on the firms' abilities to achieve the greater benefits of high international diversification that exceed the costs and risks. Third, the results of our additional tests indicate greater sensitivity to the level of competitive intensity within an industry. In particular, the relationship between international diversification and credit scores is only significant for firms in competitive industries. They also show that a firm's credit score becomes less dependent on international diversification for large firms, firms in the manufacturing sector, and firms distant from

key metropolitan areas, such as London. There is an extensive body of existing work that seeks to bring together TCE and the RBV (Ancarani, Di Mauro, & Mascali, 2019; Silverman, 1999). What this study adds to this literature is that it explores how RBV effects are most pronounced at the earlier stages of internationalisation and TCE ones at the later ones. Although it might be presumed that the consequences of internationalisation are non-linear, this study highlights how transaction costs gradually overwhelm any influences – and abilities to offset risks – that might come with greater international exposure. In other words, we seek to explore the fullest possible effects of transaction costs, not only where their consequences seemingly override resource advantages (Foss, 2003), but also when the latter are augmented through greater R&D; they may alleviate such tendencies.

The remainder of the paper proceeds as follows. Section 2 develops the theoretical framework and hypothesis to test the impact of international diversification on credit scores. Section 3 describes the methods and data used in this study. Section 4 provides the results of the main analyses, robustness checks, and additional tests. Section 5 presents the discussion and conclusion, including the implications and limitations of the study.

2   Theoretical framework and hypothesis development

A great deal of previous studies in international business literature has examined (and provided mixed evidence on) the relationship between the degree of international diversification and firm's financial performance. Some researchers (e.g., Denis, Denis, & Yost, 2002; Lu & Beamish, 2001) posit linear effects of international diversification on performance, while others (Almodóvar, 2012; Benito-Osorio et al., 2016; Boehe & Jiménez, 2016; Brock et al., 2006; Lee, 2010) suggest threshold effects (e.g., U-shaped, inverted U-shaped, S-shaped, and M-shaped curves). However, a considerable amount of international business studies use return on equity as a performance measure, without taking into consideration the effect of financial leverage in the firm's capital structure. According to Nguyen (2017, pp.329-330), "the higher the level of debt, the higher the ROE, but it also implies higher bankruptcy risks, financial distress and cost of capital for the firm". Hence, studies on international diversification-performance relationship that do not consider risks may suffer from deep flaws in their methodology (Bowe et al., 2010). In this study, we contribute to the literature by using a multidimensional measure that does not only capture the firm's profitability but also captures the dimension of default risk.[4]

We argue that the link between international diversification and credit scores is determined by the benefits, costs, and risks associated with going international. While the arguments about the benefits of international diversification are largely drawn from the RBV logic (Barney, 1991), the arguments

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[4] In this study, we adopt firms' credit scores from the Bureau Van Dijk Financial Analysis Made Easy (FAME) database. In addition to profitability, the calculation of these credit scores is based on firm's solvency, leverage, liquidity, business structure, capitalisation, working capital, cash flow, productivity, shareholder funds, lateness in filing accounts, and the presence on the public file of any adverse documents against the company.

related to the increasing costs and risks associated with over-diversification are based on TCE (Hitt et al., 1997). It is worth noting that there is no consensus on the contributions of employing theoretical triangulations in accounting and business research. For instance, Kirca et al. (2011) criticise the approach of using multiple theories to advocate for a particular shape of the international diversification and firm performance relationship on the grounds that it becomes very difficult to link the results back to the confirmation, extension, or rejection of any theory.

Despite these criticisms, the deployment of multiple theories is not without its merits. That is, using a single theory may constrain the discussion of any elements outside of it (Lukka & Mouritsen, 2002). In this study, we provide new insights on an understudied phenomenon: the impact of international diversification on credit scores, drawing upon the RBV and TCE propositions. These two theories do not structurally contradict each other and, indeed, may complement each other, illuminating the complexity of the phenomenon under study. As Lampel and Giachetti (2013, p. 214) argue, "although each may take a different view of the factors that drive and limit international diversification, a careful reading of the explanations they advance suggests these factors are often two sides of the same coin." Combining both TCE and the RBV enriches our understanding of the externalisation of activities; whilst the RBV focuses on firm-specific resources and capabilities, TCE focuses on external governance issues and how these affect interfirm relationships (Ancarani et al., 2019; Lo, Frias, & Ghosh, 2012; McIvor, 2009; Peris Bonet, Peris-Ortiz, & Gil-Pechuan, 2010). In interacting with each other, firms may align two different elements of value creation: "heterogenous, firm-specific capabilities/resources" and what is imparted by governance structures (Lo et al., 2012, p. 1282). Intrafirm resource may indeed exist interdependent of cooperative external relations yet together may impact back on the wider context (Lo et al., 2012). It can also be argued that resources can be exploited through both diversification and efficiency in contracting (Silverman, 1999).

In support of our argument, for example, some argue that combining TCE with the RBV would provide more-encompassing explanations of managers' decisions to enter foreign markets than employing either logic solely (e.g., Li, Eden, Hitt, & Ireland, 2008; Martin & Salomon, 2003). This is because the entry decision depends not only on risk and control considerations (TCE) but also on the firm's capabilities and hard-to-imitate resources (RBV), such as experience and knowledge, which can influence managers' perceptions of host market costs (Surdu & Mellahi, 2016). The RBV and TCE can also be combined to obtain a better understanding of the benefits and costs associated with greater diversity at different levels of international diversification (e.g., Hitt et al., 1997), thus complementing the deficiencies of using either perspective alone. Similarly, Mohr, Wang, and Goerzen (2016) hold the view that the RBV and TCE provide complementary, rather than competing, explanations of the effects of greater diversity within multiparty international joint ventures. As such, combining these two theories

offers a much finer-grained view of the link between international diversification and credit scores than using them in isolation.

From the RBV logic, international diversification helps firms to use their internal resources and capabilities effectively to exploit the inefficiencies in international markets (e.g., differences in national resources), thereby achieving greater returns (e.g., Barney, 1991; Peng, 2001; Robins & Wiersema, 1995; Silverman, 1999). Internationally diversified firms can also exploit economies of scale with their internal resources (Hitt et al., 1997) and realise potential locational advantages by applying innovations and diverse ideas, often generated in divisions/units operating in different geographical locations (increasing the knowledge spillover between divisions).

Firms can effectively utilise their intangible hard-to-imitate resources in cross-border operations in order to offset risks and enhance their performance (e.g., Silverman, 1999; Wan, Hoskisson, Short, & Yiu, 2011). By engaging in cross-border operations, firms can benefit by gaining knowledge about foreign markets and can also apply the knowledge and skills gained in their home country operations in different global markets to improve their financial performance (Kostova & Roth, 2002; Love, 1995; Porter, 1990; Zahra, Ireland, & Hitt, 2000). Existing literature suggests that profitable firms have significantly higher credit ratings (Alissa, Bonsall IV, Koharki, & Penn Jr., 2013; Ashbaugh-Skaife, Collins, & LaFond, 2006). Thus, we would expect a positive relationship between international diversification and credit scores. However, this impact may not be linear, given the increasing costs and risks associated with high levels of international diversification which will offset the benefits achieved (Batsakis & Mohr, 2017).

Based on TCE, highly diversified firms are likely to experience higher transaction costs (e.g., logistical costs, trade barriers, cultural diversity, and information-processing costs); as such, firms have to coordinate their value chains' activities across diverse markets. In this regard, scholars (Gupta, Wilson, Gregoriou, & Healy, 2014; Hitt et al., 1997; Jones & Hill, 1988; Krapl, 2015; Kwok & Reeb, 2000; Lu, Liu, Filatotchev, & Wright, 2014; Roth, 1992; Tsai, 2014) argue that firms tend to overstretch their internal resources as they continue to diversify internationally. At high levels of diversification, the transaction costs will exceed the benefits derived from international diversification, which requires coordination across different and isolated geographical regions (Capar & Kotabe, 2003; Kim & Mathur, 2008), leading to a decrease in the returns on their investments and thus diminishing profits (Hitt et al., 1997).

It has been argued that moderately diversified firms yield higher returns than their highly diversified counterparts (Zúñiga-Vicente, Benito-Osorio, Guerras-Martín, & Colino, 2019). Hence, firms enjoy a higher financial performance at low and moderate levels of international diversification, but their performance slows down and eventually becomes negative as international diversification intensifies

(Hitt et al., 1997), which may lead to lower credit scores at higher levels of diversification. In addition, the costs associated with international diversification may increase the level of firm risk. In reference to transaction costs, Hitt and his colleagues suggest that these costs may differ greatly across different geographical regions, which in turn increases firms' risks (and exposure to environmental uncertainty), and "these risks cannot be easily hedged" (1997, p. 773). Along the same lines, Clemons, Reddi, and Row (1993) suggest that transaction risks represent a major component of transaction costs. Three factors can lead to an increase in the transaction risks associated with internationalisation, namely environmental uncertainty, information asymmetry (especially in offshoring and outsourcing situations), and the risks associated with the investments in asset specificity necessary to support the transaction (Stratman, 2008).

Studies on international diversification and risk (e.g., Krapl, 2015; Olibe, Michello, & Thorne, 2008; Reeb, Kwok, & Baek, 1998) have suggested that international diversification increases the systematic risk[5]. This is because internationally diversified firms are exposed to more-complex operating environments, unfavourable tax regimes, political risk, corruption, fluctuations in foreign exchange rate, and the opportunistic behaviour of local actors (Mahajan, Muller, & Bass, 1990; Michel & Shaked, 1986; Pantzalis et al., 2008; Reeb et al., 1998). Such institutional challenges increase the uncertainty about the firm's growth prospects (Reeb, Mansi, & Allee, 2001), thus increasing firm-unique risk which could absorb the international diversification benefits. In the words of Nguyen (2017, p. 325), "financial risks, such as exchange rate fluctuations and inflation … might offset the benefits of earnings stability derived from worldwide portfolio diversification". The impact of such risks depends on the level of diversification as the risks associated with international diversification are higher for highly diversified firms (Krapl, 2015).

In light of all the above discussions, we argue that low and moderate levels of international diversification are associated with higher credit scores. This is because in firms that are not highly diversified, the benefits outweigh the costs (Pantzalis et al., 2008), diversification is less complex or less difficult to manage (Lu et al., 2014), and the level of risk is lower (Krapl, 2015). However, at high levels of diversification, the benefits of international diversification begin to decrease with the increasing costs and risks, which could have a negative impact on firms' credit scores. Thus, we propose an inverse U-shaped curvilinear relationship between international diversification and credit scores; the slope and shape of this nonlinear relationship between international diversification and credit scores varies with the level of international diversification.

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[5] The systematic risks arising from international diversification include exchange rate, political, and cross-cultural risks (Reeb et al., 1998; Strange, 2018).

H1. *The relationship between international diversification and firms' credit scores is nonlinear, with the slope positive at low and moderate levels of international diversification but negative at high levels of international diversification.*

Although our proposed curvilinear relationship between international diversification and credit scores should hold for all firms, the net influence of international diversification could vary across firms due to the heterogeneity in firms' resources and capabilities. Under the RBV, firms are bundles of unique resources and capabilities (Barney, 1991; Peteraf, 1993). With these unique resources and capabilities, firms are better able to realise the advantages of international diversification through maximising the gains while minimising the associated costs/risks (Kotabe et al., 2002). Firms with innovative capabilities can also mitigate the liability of foreignness due to the acquisition of foreign markets knowledge and experience as they expand into different host markets by leveraging their knowledge and capabilities (cf. Grant, 1996). Thus, innovation in products and/or processes can moderate the relationship between international diversification and credit scores.

Extant studies have suggested that innovation is a key driver of better firm performance (e.g., Jiménez-Jiménez & Sanz-Valle, 2011). When going international, innovation becomes important to produce greater organisational efficiencies (Grant, Jammine, & Thomas, 1988) and to gain competitive advantages in international markets (Franko, 1989; Porter, 1990). To produce innovation, firms invest in long-term capabilities such as R&D (Hitt et al., 1997). These firms should be able to generate abnormally high returns from their international expansion through economies of scale and scope, learning economies, and the exploitation of market imperfections (Kotabe et al., 2002).

Empirically, McGuinness and Little (1981) found that innovative new products that have certain new product characteristics enjoy better export performance. Based on a sample of US firms, Braymen, Briggs, and Boulware (2011) suggest that innovation in processes and products helps firms to reduce production costs and produce a variety of goods with rising demand in global markets. In export markets, therefore, innovative firms can increase the sale volumes of their better-quality goods or obtain a higher mark-up, resulting in sales growth (Golovko & Valentini, 2011).

On the other hand, in spite of the previously mentioned benefits, innovation can be a risky undertaking (Eisenhardt & Martin, 2000). More advanced technologies bring with them greater challenges in understanding, communicating, and integrating their effects (Cheah, Bellavitis, & Muscio, 2020). Again, as R&D is often more commonly organised via hierarchies, rather than markets, greater intensity may make for complexity in exchange relations (Wang, Libaers, & Park, 2017). Hence, greater R&D intensity is likely to raise transaction costs (Cheah et al., 2020).

However, recent applied evidence suggests different outcomes. For example, Purkayastha, Manolova, and Edelman (2018) conclude that greater R&D intensity is associated with greater internationalisation,

as any problems may be mitigated through internal structures and governance. Booltink and Saka-Helmhout (2018) argue that internationalisation seems to create more opportunities to exploit R&D advantages more effectively. As Hitt, Hoskisson, and Ireland (1994, p. 307) state, "international diversification provides the potential for firms to achieve greater returns on innovations (larger and/or a greater number of markets with different demand characteristics) and thus, lowers the risks of R&D investments." This is in line with the contention of Golovko and Valentini (2011) that exports and innovation are complementary strategies for firms' growth. Thus, the returns on innovations will be greater in highly diversified firms.

In this study, we posit that firms with innovative capabilities, measured by R&D intensity, will be able to achieve greater advantages from international diversification that exceed the associated costs and risks, thereby having higher credit scores. In particular, highly diversified firms, which experience higher transaction costs, including both coordination costs and transaction risks, will benefit from the investment in R&D such that the transaction costs do not exceed the benefits of multinationality. As such, high levels of internationalisation associated with R&D intensity will have a positive influence on credit scores. Furthermore, investment in R&D contributes to the development of firm-level absorptive capacity (Cohen & Levinthal, 1990), which in turn enables firms to acquire external knowledge and generate innovation (e.g., Khan, Lew, & Marinova, 2019). Thus, we suggest that:

H2. *R&D intensity positively moderates the curvilinear relationship between international diversification and firms' credit scores.*

Figure 1 illustrates the conceptual framework of this study.

Figure 1. Conceptual framework and hypothesis
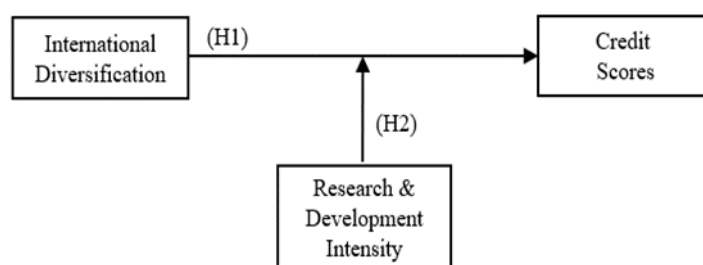
To summarise, we propose a curvilinear relationship between international diversification and firms' credit scores that begins positive but eventually becomes negative with high levels of international diversification. While the RBV highlights the benefits of international diversification, TCE explains how the increasing costs and risks associated with high levels of international diversification will offset the benefits achieved, thus explaining the proposed inverse U-shaped relationship between international diversification and credit scores. Firms with unique capabilities and resources, according to the RBV,

will be able to achieve the greater benefits of international diversification; therefore, we propose that R&D intensity moderates the relationship between international diversification and credit scores.

3   Methods

3.1   Data collection and sample

To conduct our empirical analysis, we collected data on UK firms from FAME database, which provides data for the largest number of UK companies in comparison with other databases. Our sample consisted of 11,118 UK firms that had credit scores between 2016 and 2017 and had filed their full accounts in accordance with International Financial Reporting Standards (IFRS). We excluded 3,408 firms operating in the financial industry, as they are subject to different regulations from other industries. We also excluded 1,153 firms with missing data on the control variables. Our final sample, therefore, included 6,557 firms. Table 1 reports the sample distribution by industry. The sample consisted of eight broad industries defined according to the Standard Industrial Classification (SIC) code. The largest portion came from 'Services' (46.58%), followed by 'Manufacturing' (14.47%) and 'Transportation, Communications, and Utilities' (13.82%).

[Insert Table 1 here]

3.2   Variable measurement

The dependent variable in the study was the credit score ($Credit\_Score$) provided by the FAME database, which captures the likelihood of a business becoming insolvent over a period of 12 months, ranging from 0 to 100, with lower scores indicating a greater probability of default risk. This proxy has been used in previous accounting and finance studies (e.g., Dedman & Kausar, 2012; Peel, 2018) and is preferred over other ratings, such as those developed by Standard and Poor's (S&P), Moody's, and Fitch, as these ratings are only available for a small number of UK firms (i.e., for those that voluntarily choose to get rated). The majority of companies decide not to get rated because the cost of getting rated is asymmetrically severe if the rating is later downgraded (Palepu, Healy, & Peek, 2016).

For the independent variables, the two main variables were international diversification (Int_Div), measured as the percentage of international sales to total sales, and Int_Div_SQ, measured as the squared percentage of Int_Div. We also included R&D_Intensity in the analysis to examine the moderating impact of innovation on the relationship between international diversification and credit scores. Similar to prior research (e.g., Block, 2012; Fratianni & Oh, 2009), R&D_Intensity was measured as the ratio of R&D expenditure to total assets.

In addition to the independent variables, we included a number of control variables suggested in earlier literature (e.g., Alissa et al., 2013; Dedman & Kausar, 2012; Florou, Kosi, & Pope, 2017; Peel, 2018). The return on capital employed (ROCE) is the ratio of profit before tax to capital employed. Sales growth (Sales_Growth) is the percentage change in the firm's sales from period t-1 to t. The firm's net working capital ratio (WC_TA) is calculated by dividing working capital by total assets. The firm's leverage (LEV) is the ratio of long-term debt to total assets. Firm size (SME) is an indicator that takes the value of 1 if the firm is classified as a small or medium-sized enterprise by the FAME database and 0 otherwise[6]. Firm age (AGE) is the natural logarithm of the years since the firm's incorporation. We also included an indicator variable (NEG_EQTY) that took the value of 1 for firms with negative equity and 0 otherwise. In addition, we included a regional classification variable (Geographic_Locus) ranging from domestic to global, which captures the geographical locus in which firms' international activities are carried out (for all models, the reference group is domestic). We provide detailed variable definitions in Appendix I.

3.3   Estimation methods

We first employed the following model to examine whether international diversification affects firms' credit scores:

$$
\begin{aligned}
Credit\_Score = {} & \alpha + \beta_1 Int\_Div + \beta_2 Int\_Div\_SQ + \beta_3 ROCE + \beta_4 Sales\_Growth + \beta_5 NEG\_EQTY + \beta_6 WC\_TA \\
& + \beta_7 LEV + \beta_8 AGE + + \beta_9 SME + \beta_{10} Geographic\_Locus + Industry\ fixed\ effects \\
& + \varepsilon
\end{aligned} \tag{1}
$$

Our variables of interest in model 1 were Int_Div and Int_Div_SQ. The positive coefficient of β_1 and the negative coefficient of β_2 support H1.

To test the moderating impact of innovation on the relationship between international diversification and credit scores, we estimated the following regression equation:

$$
\begin{aligned}
Credit\_Score = {} & \alpha + \beta_1 Int\_Div + \beta_2 Int\_Div\_SQ + \beta_3 R\&D\_Intensity + \beta_4 Int\_Div \times R\&D\_Intensity \\
& + \beta_5 Int\_Div\_SQ \times R\&D\_Intensity + \beta_6 ROCE + \beta_7 Sales\_Growth + \beta_8 NEG\_EQTY + \beta_9 WC\_TA \\
& + \beta_{10} LEV + \beta_{11} AGE + + \beta_{12} SME + \beta_{13} Geographic\_Locus + Industry\ fixed\ effects \\
& + \varepsilon
\end{aligned} \tag{2}
$$

In model 2, our variables of interest were Int_Div×R&D_Intensity and Int_Div_SQ×R&D_Intensity, which measured the effect of innovation on the relationship between international diversification and credit scores. The positive coefficients of β_4 and β_5 support H2.

In both models, we included industry fixed-effects dummy variables to control for heterogeneity across industries. We further ran several robustness tests (as reported in Section 4.2) to test for the existence

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[6] The total assets variable is not always a good measure of firm size because not all assets contribute equally to a reduction in credit risk. Intangible assets and current assets (e.g., accounts receivable) are more likely to be the major causes of a company's financial difficulties, rather than risk-reducing factors (Palepu et al., 2016).

of a sigmoid function, reverse causality, and endogeneity. In addition, we conducted additional tests (as reported in Section 4.3) to examine whether the impact of international diversification on credit scores differed according to industry competition, industry sector, firm's distance to London, and firm size.

4   Results

4.1   Main results

Table 2 reports the descriptive statistics for the variables used in the regressions. To mitigate the influence of outliers, all continuous variables were winsorised at the top and bottom 1% of their respective distributions. The mean value of Int_Div was 0.129, suggesting that foreign sales accounted for 12.9% (or approximately 13%) of total sales, which is somewhat comparable to the figures reported in prior studies (e.g., Berrill, Kearney, & O'Hagan-Luff, 2019; Capar & Kotabe, 2003).[7] The mean value of SME was 0.602, indicating that about 60% of the sample firms were small or medium-sized.

[Insert Table 2 here]

Table 3 reports the correlation coefficients among the variables used in the regressions. Most of the correlations between the dependent variable (Credit_Score) and other variables were significant at the 5% level and below. The correlations among the independent variables indicate no problem of multicollinearity. In support of this assertion, the untabulated results of the variation inflation factor (VIF) test show that all VIF values were much lower than the critical cut-off point of 10.[8]

[Insert Table 3 here]

Table 4 reports the empirical results of the regression analyses testing the effect of international diversification on credit scores. The F-tests indicate that all model coefficients were jointly significant, indicating that the model was well specified overall. The first column of Table 4 shows that the effect of international diversification (Int_Div) on firms' credit scores (Credit_Score) was statistically significant, and the regression model accounted for 26% of the variance in firms' credit scores, which is comparable to prior research (e.g., Capar & Kotabe, 2003).

In particular, there was a statistically significant and positive relationship between Int_Div and Credit_Score (β=0.125, t-statistic=3.47) whereas there was a negative relationship between

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[7] As a follow-up, we ran a one-way analysis of variance (ANOVA) to see if there was any group difference in credit scores for firms below and above the 13% threshold level. The untabulated results reveal that the high international diversification group of firms had a higher average credit score (μ=81.88, σ=21.60) than the low international diversification group of firms (μ=77.05, σ=22.76), and the difference was statistically significant (F=47.97, p=0.000).

[8] However, it is important to note that multicollinearity or a high VIF score does not necessarily lead to spuriously significant results. This is particularly true because multicollinearity does not violate any regression assumptions (Wooldridge, 2014) and does not deflate (but rather inflates) the standard errors of coefficients, making it harder to find statistical evidence for relationships between the independent and dependent variables. As Lindner, Puck, and Verbeke (2020) suggest, "the higher the collinearity, i.e., the higher the VIFs, the harder it is to find statistical evidence of a relationship" (p. 287).

international diversification squared (Int_Div_SQ) and Credit_Score (β=-0.132, t-statistic=-3.246).[9] These two relationships combined indicate that a curvilinear (inverted U-shaped) relationship exists between international diversification and firms' credit scores. This result provides support for H1.

[Insert Table 4 here]

As far as the firm-level control variables are concerned, firms with higher WC_TA and Sales_Growth had higher credit scores. Among the control variables, LEV and NEG_EQTY were negatively associated with Credit_Score. This is consistent with the findings of a number of studies (e.g., Alali, Anandarajan, & Jiang, 2012; Choi, Kim, & Lee, 2011; Dedman & Kausar, 2012; Kim, Simunic, Stein, & Yi, 2011), demonstrating that credit scores are lower for firms with higher leverage and negative equity due to higher borrowing costs. Firm age was positively associated with Credit_Score, suggesting that credit scores are higher for mature, well-established, or widely recognised firms, which is consistent with earlier work (Pittman & Fortin, 2004). The association between Credit_Score and SME was negative, indicating that larger enterprises have higher credit scores than SMEs do.

To examine the curvilinear relationship between international diversification and credit scores in more depth, we cluster-analysed the sample of firms, grouping them by their international diversification scores following a procedure used by Hitt et al. (1997). The analysis suggested two subgroups: subgroup 1 consisted of 1,340 highly diversified firms (with scores of 0.11 and above and an average value of 0.62), while subgroup 2 consisted of 5,217 non-diversified, lowly/moderately diversified firms (with scores below 0.11). We then ran a one-way ANOVA to see if the group means were significantly different from each other. The ANOVA test results (untabulated) show that the highly diversified group had an average credit score that was higher (μ=82.14, σ=21.37) than the low/moderate group (μ=76.94, σ=22.80), and the difference was statistically significant (F=56.84, p=0.000).

We also developed regression models for each group to examine the relationship between international diversification and credit scores. The untabulated results of the analysis based on clustering the firms into two subgroups, the lowly and moderately diversified group and the high diversified group, show that the relationship between Int_Div and Credit_Score was positive for the low and moderate diversified group but negative for the highly diversified group. This confirms the hypothesised inverse U-shaped curvilinear relationship. Our findings suggest that firms can, indeed, take advantage of their diversification. However, the effect of diversification eventually levels off and then becomes negative (the inflection point for the curve is 0.473); after this point the diversification benefits will be depreciated as the costs that comes with over-diversification outweigh the benefits.

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[9] We performed additional regression to check whether scaling foreign sales by total assets instead of total sales affected our results. The results were essentially the same as when scaling by total sales.

Columns 2 and 3 of Table 4 report the results of the regression analysis testing the moderating impact of innovation on the relationship between international diversification and firms' credit scores. Consistent with our prediction, our results show that R&D_Intensity had a statistically significant and positive impact on the relationship between Int_Div_SQ and Credit_Score (β=0.188, t-statistic=2.569), while its impact on Int_Div was only marginally significant at the 10% level (β=0.144, t-statistic=1.692).[10] As such, innovative firms are better able to maximise the (net) benefits of international diversification at the point where the total benefits of multinationality exceed the total costs. This result provides support for H2.

4.2 Robustness checks

We also performed a battery of robustness checks. First, we tested for the existence of a sigmoid function (S-curve) using the cubic term of the international diversification variable (Int_Div_cubic). Our untabulated results show that the linear and quadratic regression coefficients for Int_Div and Int_Div_SQ were significant, but the coefficient for Int_Div_cubic was insignificant (β=0.249, t-statistic=1.516). These results confirm our earlier findings on the inverted U-shaped relationship between international diversification and credit scores, with all signs and levels of significance closely corresponding to those found for the coefficients in Table 4. Thus, we found no evidence of an S-shaped pattern.[11]

We also plotted the relationship between international diversification and credit scores using the actual (and predicted) values from our sample, as shown in Figure 2. The figure shows that credit scores first increase as firms diversify internationally and then decrease at extremely high levels of diversification. Second, similar to prior research (e.g., Ren, Eisingerich, & Tsai, 2015), we examined the possibility of 'reverse causality' by running a reverse regression in which the international diversification variable was viewed as endogenous to firms' credit scores and the other variables. The model assumed that firms' credit scores affect their international diversification and not the other way around.[12] The untabulated results show that the coefficient on Credit_Score was statistically insignificant (β=0.019, t-statistic=1.104). This evidence suggests that the direction of causality runs from international
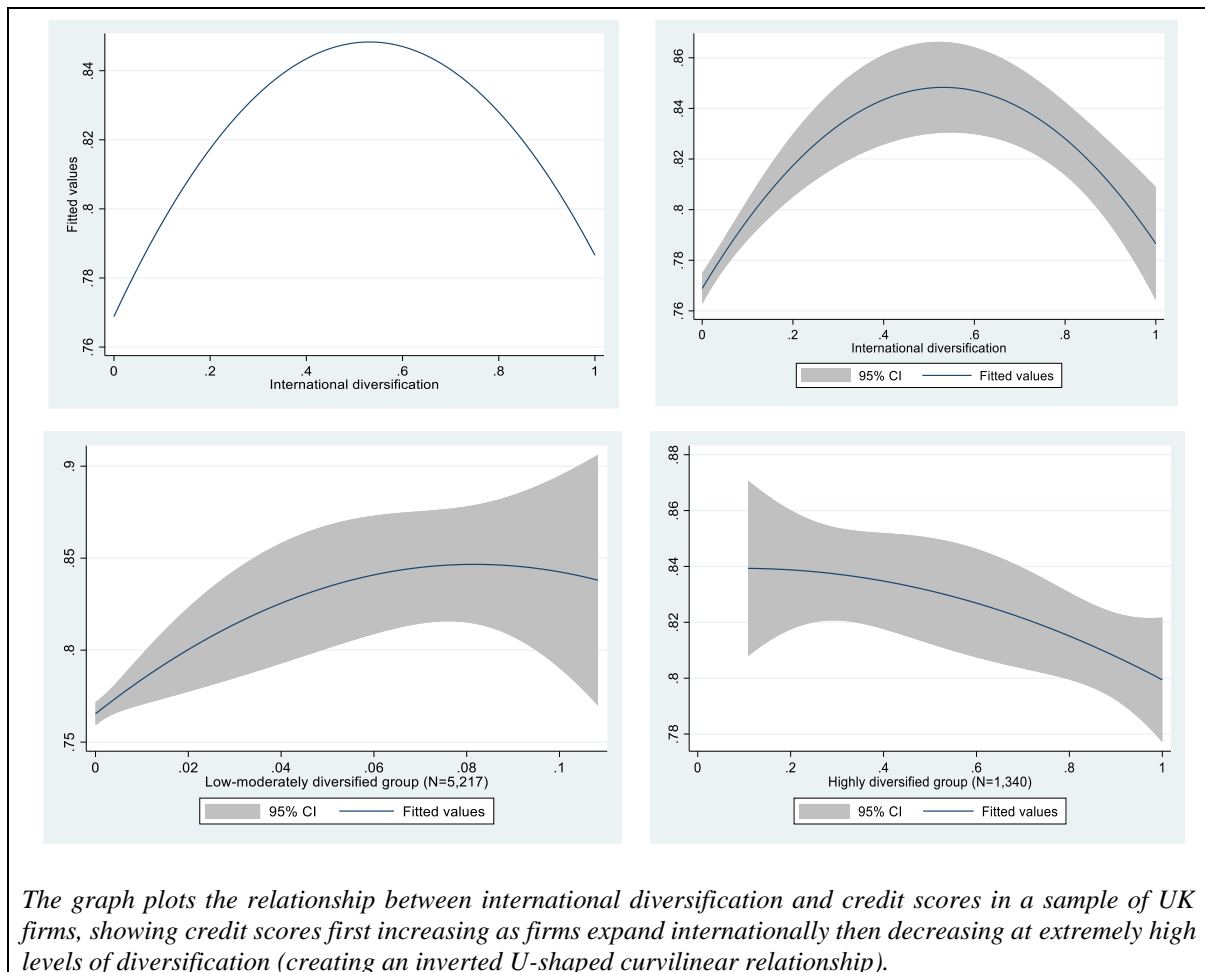
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[10] We replaced R&D_Intensity with the ratio of intangible assets to total assets, but we could not find any significant effect (either direct or indirect) on firms' credit scores. Perhaps that is because although intangible assets represent an important input into the innovative process, the intangible assets/total assets ratio is not an accurate measure of innovation than R&D (R&D_Intensity has emerged as the most robust/reliable measure of innovation in the multinationality literature). From an accounting perspective, the concept of 'intangible assets' has a much broader sense than the strict technical one it has in R&D. For instance, it includes items that are not related to R&D, such as goodwill. More critically, R&D rarely meet the criteria for being recognised as an intangible asset. According to IAS 38 (Intangible Assets), all expenditure incurred at the research stage is to be written off to the income statement as an expense when incurred, and hence it will never be capitalised as an intangible asset; whereas the development expenditure is capitalised as an intangible asset if certain criteria are met. This means that only a proportion of the development costs during the development stage is capitalised.

[11] The evidence in this study corroborates the findings of prior research (e.g., Berry & Kaul, 2016; Pisani et al., 2020) examining the multinationality–performance relationship but failing to find evidence of an S-shaped relationship.

[12] We also re-estimated model 1 using the lagged values of Int_Div and Int_Div_SQ. The results were qualitatively the same as those tabulated.

diversification to credit scores, rather than the other way around; thus, we rejected the possibility of reverse causality.[13]

Figure 2. International diversification versus credit scores

The graph plots the relationship between international diversification and credit scores in a sample of UK firms, showing credit scores first increasing as firms expand internationally then decreasing at extremely high levels of diversification (creating an inverted U-shaped curvilinear relationship).

Another concern with our inference was that it might have been affected by the potential sample selection and the endogeneity of a firm's internationalisation (see, for example, Reeb, Sakakibara, & Mahmood, 2012). In particular, firms may self-select to go international, and this choice may be driven by factors that also affect their credit scores. We addressed this concern by adopting one-to-one propensity score matching (PSM), which controlled for sample selection based on observable differences in firm characteristics and unobservable industry heterogeneity among highly and lowly/moderately diversified firms. As we had more observations for lowly/moderately diversified firms, we considered highly diversified firms to be the treated group and lowly/moderately diversified firms to be the control group. The propensity scores were estimated using probit regression based on all

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[13] In further analysis (untabulated), we conducted a path analysis to establish whether internationalisation affects credit scores indirectly through firm performance (mediation effect). We found that the 'direct' effect of international diversification on credit scores remained statistically significant, whereas the 'indirect' effect running from international diversification to credit scores through firm performance was insignificant, suggesting that there was no mediation.

the control variables in our baseline regression (given by equation 1), as well as industry effects. Panel A in Table 5 presents the pairwise differences between the mean credit scores of the treated and control firms. We found that the credit scores for highly diversified firms were, on average, 5.20 and 1.47 percentage points higher than those for lowly/moderately diversified firms. Panel B presents the results from our re-estimation of the baseline regression model using the PSM sample, and the results confirm our earlier baseline findings.

[Insert Table 5 here]

4.3 Additional tests

To provide a more comprehensive picture of the effect of international diversification on firms' credit scores, we investigated whether this effect is sensitive to the degree of competitiveness in an industry. The extant literature indicates that increasing competition has a negative effect on profits (Boubaker, Saffar, & Sassi, 2018; Bowen & Wiersema, 2005; Peress, 2010; Slade, 2004), which in turn increases the liquidation risk, thereby affecting managerial incentives (Schmidt, 1997). Under the threat of liquidation, corporate executives will have strong incentives to increase profits and reduce costs to avoid going into insolvent liquidation. To this end, the executives of firms in competitive industries tend to expand internationally to buffer the effects of competition (Hitt, Tihanyi, Miller, & Connelly, 2006).

On the other hand, the executives of firms in concentrated/highly concentrated industries will have different incentives than those in competitive industries due to their monopolistic position. We calculated the Herfindahl–Hirschman Index (HHI) to measure the degree of industry competition. The HHI is computed by summing the squared market shares of all firms competing in an industry. A firm's market share is given as a ratio of the firm's sales to total sales in its industry. The HHI can range from close to 0 to 10,000, with higher values indicating greater industry concentration. We split the sample firms into two subgroups: subgroup 1 consisted of firms operating in highly competitive industries (HHI≤1,500), while subgroup 2 consisted of firms operating in concentrated or highly concentrated industries (HHI>1,500). We then ran model 1 for each group to examine whether the level of competition within the industry influences the impact of international diversification on credit scores.

Columns 1 and 2 of Table 6 show that the relationship between international diversification and credit scores was significant only for firms operating in industries with higher levels of competitive intensity (Int_Div, β=0.131, t-statistic=3.09; Int_Div_SQ, β=-0.149, t-statistic=-3.06). However, the relationship between international diversification and credit scores was not significant for firms operating in concentrated and highly concentrated industries. This means that low and moderate levels of international diversification are beneficial for firms in industries with high levels of competition, whereas high levels of international diversification have a negative impact on their credit scores,

indicating an inverted U-shaped relationship. The credit scores of firms operating in concentrated or highly concentrated industries, however, are less dependent on international diversification.

[Insert Table 6 here]

We also ran the analysis (model 1) for manufacturing firms and services separately, as these two sectors behave differently (Farok, Vikas, Sumit, et al., 2007). The results in columns 3 and 4 of Table 6 show that the inverted U-shaped relationship we found in our main analysis stood only for services; international diversification had an insignificant impact on the credit scores of manufacturing-based firms.

Further, we investigated the sensitivity of the relationship between international diversification and credit scores to the firm's distance from London, being the main financial centre in the UK. Prior studies have investigated different topics related to the distances between firms and their lenders or financial centres. For example, DeYoung, Glennon, and Nigro (2008) analysed borrower–lender distance, credit scoring, and loan performance using a sample of SMEs in the US, while Saunders and Steffen (2011) investigated the impact of firm distance from central London on SMEs' tendency to go public. In the present study, the distance variable was the driving distance between the headquarters of the firm in the postcode area and the centre of London using the road network measured in miles, as in the work of Saunders and Steffen (2011). We clustered the firms into 'close to London' and 'distant from London' based on the median of the distance variable (31.4 miles).[14] In Table 7, columns 1 and 2 reveal that the impact of international diversification was significant only for firms close to London. Column 3 in Table 7 shows that firms distant from London tended to have higher credit scores.[15]

Although we controlled for firm size in model 1, we re-ran the model for SMEs and large firms separately. This is because SMEs may benefit from international diversification more than larger firms do (Loth & Parks, 2002). By doing so, we investigated whether the impact of international diversification on credit scores is sensitive to firm size. Columns 4 and 5 in Table 7 show that international diversification had a significant impact on SMEs' credit scores but not on the credit scores of large firms.

[Insert Table 7 here]

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[14] To examine the difference between the mean values of the credit scores across the two distance groups (distant vs. close), a one-way ANOVA was carried out, and the untabulated results of the ANOVA reveal that there was a statistically significant difference between the two means (F=20.56, p=0.000). In addition, Appendix II (Panels A and B) reports the results from a Tukey post hoc test performed to determine the mean difference between the two distance groups and whether the difference between the group means was statistically significant. The results reveal that the mean difference between the two groups (distant vs. close) was 3.06 and was statistically significant. Our results indicate that firms that were geographically close to London had credit scores that were statistically significantly lower (μ=77.34, σ=23.12) compared to distant firms (μ=80.40, σ=20.55).

[15] Model 3 reveals the direct impact of distance from London on firms' credit scores.

5   Discussion and conclusion

In this paper, we have argued that the benefits, costs, and risks associated with international diversification are the three channels through which international diversification influences credit scores. The arguments about the benefits of international diversification were based on the RBV logic (Barney, 1991; Peteraf, 1993), whereas the arguments related to the increasing costs and risks associated with over-diversification were drawn from TCE (Hitt et al., 1997). Using a large sample of 6,557 UK firms, we found that low and moderate levels of international diversification were associated with higher credit scores; however, high levels of international diversification were associated with lower credit scores.

As per the RBV logic, firms can create economies of scale advantages through leveraging their firm-specific resources and capabilities in new markets (Teece, 1982), which influences firms' performance positively, thus lowering their credit risk. Firms can also benefit from international diversification by spreading their fixed costs across international markets, achieving economies of scale (Kobrin, 1991). It is not surprising that realising economies of scope and scale via international diversification has a positive impact on credit scores, as it contributes to better firm performance. This is consistent with the findings of Griffin, Hong, and Ryou (2018), who suggest that "firms' economies of scale and profitability associate with better credit ratings" (p. 361). Furthermore, operating in foreign markets can also improve firms' capabilities and knowledge bases through experiential learning (Vermeulen & Barkema, 2001; Puthusserry et al., 2020), thereby improving their financial performance.

Another possible explanation of the positive effect of international diversification on credit scores is that firms operating across international markets have operational flexibilities that contribute to risk diversification and lower earnings fluctuations (Kim et al., 1993), which translate into lower credit risk. This is because operating in multiple national markets helps a firm to face the aggressive challenges of its local competitors (Kim & Mauborgne, 1988). Firms that engage in international diversification can also minimise the impacts of adverse changes in a country's goods and raw materials prices, wage rates, and interest rates through shifting production and other sites to more-favourable markets (Porter, 1986). The lower earnings fluctuations of firms that engage in international diversification stem from their ability to face the fluctuations in the supply and demand of one national market through their operations in other national markets (Kim et al., 1993).

At a certain point, however, the increasing costs and risks of diversification outweigh the benefits due to the complexities of managing the communication and information needed among the widespread units operating in diverse institutional settings (Capar & Kotabe, 2003; Contractor, Kundu, & Hsu, 2003; Kim & Mathur, 2008). As such highly diversified firms are more likely to be hit by foreign exchange uncertainty, in addition to the uncertainty that comes with the complexity of cross-border

operations; therefore, the risk involved in international diversification is higher for highly diversified firms (Krapl, 2015).

Combining the RBV and TCE explains the inverted U-shaped relationship between international diversification and credit scores. That is, at low and moderate levels of international diversification, firms benefit from leveraging their unique resources across global markets by achieving economies of scope and scale and increasing their foreign market knowledge. By leveraging their diverse host markets knowledge—firms can mitigate their liability of foreignness and reap the benefits of diversification by lowering transaction costs of their value chains activities. When the level of international diversification becomes high, however, the increasing transaction costs and risks outweigh the benefits realised from going international, and therefore the relationship between international diversification and credit score reverses to become negative. It would be quite predictable that greater exposure to multiple institutional regimes makes for a greater scale and scope of contextual pressures, and greater complexity in transactions (Ancarani et al., 2019). However, it might also be presumed that as the firm becomes a more significant international player, it may be better equipped to impact back on structural dynamics, and mould the behaviour of other actors (cf. Lo et al., 2012). Yet, the study indicates that this is not the case: complexity in transacting ultimately seems to overwhelm the influence—and ability to hedge risks—that might come from greater international exposure.

We also found that innovation, captured by R&D intensity, has a positive moderating impact on the relationship between international diversification and credit scores. R&D intensity is a reflection of the innovative capabilities of a firm in designing unique products and improving product quality (Tsai, 2014). Unique and high-quality products provide a firm with a competitive advantage when going international, mitigating the negative effects of high international diversification on firm performance and risk. As such, firms with innovative capabilities can generate high abnormal returns when operating internationally through economies of scale and scope (Kotabe et al., 2002). Why is this seemingly at odds with earlier work that suggests that transaction costs may rise with greater R&D intensity (Wang et al., 2017)? Quite simply, it is possible that resources and (lower) transaction costs may not simply be complementary in making for organisational effectiveness, but that each may serve in a compensatory role for the other. In other words, higher transaction costs may be offset through greater internal resources and capabilities. Earlier work suggests that resource utilisation may be facilitated through efficiency in contracting (Silverman, 1999; Wang et al., 2017); this article suggests that the converse may also be true.

Again, there is much evidence of improvement and then diminishing returns from R&D intensity (Kim, 2018), and this holds true for SMEs whose activities span national boundaries (Booltink & Saka-Helmhout, 2018). Hence, this would suggest that taking account of R&D spend would not significantly

change the inverted U-shaped relationship between diversification and credit scores. However, confirming our second hypothesis, this was not the case in our study; rather, R&D spend had the effect of ameliorating the tendency of credit scores to diminish as diversification increases. This might suggest that sentiments play a more important role when R&D enters the picture (Shin & Subramanian, 2019). In turn, managers in heavily diversified firms may have the incentive to invest in R&D if they believe that this will improve their firms' credit scores, regardless of whether the investment pays off or not. Again, this might suggest that exuberance may be followed by disillusionment, with speedy corrections to credit scores.

Interestingly, we found that the effect of international diversification on credit scores is sensitive to the degree of competition in the industry, as international diversification only influences credit scores for firms in competitive industries. Similar to our main results, a higher level of international diversification is not optimal for firms in competitive industries, given the costs associated with higher levels of international diversification. It is suggested that firms facing intense competition are likely to go bankrupt (Schmidt, 1997). This is because competition is associated with lower profits (Boubaker et al., 2018; Bowen & Wiersema, 2005; Peress, 2010; Slade, 2004), lower firm value (Beiner, Schmid, & Wanzenried, 2011), and increased profit/cash flow volatility (Mueller, 1977; Safdar, 2016). These factors could affect the firm's credit risk or creditworthiness through their negative impacts on the accuracy or reliability of the forecasts of its future profits (Krapl, 2015). There is an extensive body of economic history literature that suggests that the role of monopolies and oligopolies in national economies is often underestimated (Kellner, 2019; Wallerstein, 1991). It seems that credit analysts are well aware of this and duly reward firms that attain such a status.

When operating in international markets, however, firms in competitive industries have an advantage over their rivals. International diversification gives firms the chance to enjoy better performance when diversifying their operations across global markets (Kim et al., 1993; Kim & Mauborgne, 1988). As such, international diversification seems to be a solution to face competitors in the local market, as firms in competitive industries tend to have better performance when expanding their activities across international markets because they can effectively utilise their firm-specific advantages. On the other hand, our findings show that international diversification has no impact on the credit scores of firms in concentrated/highly concentrated industries, as their monopolistic position enables these firms to achieve high performance. Either these firms may not feel the need to seek international diversification, given their dominance in the local market, or international diversification has a marginal impact on their performance, as national sales may represent the majority of their overall sales.

An additional industry analysis showed that the relationship between international diversification and credit scores is only significant for service-based firms. This is in part due to the fact that firms in the service industry can reap the positive benefits of international expansion and achieve learning

advantages, as well as due to their ability to generate and assimilate new foreign knowledge (i.e., they are knowledge-intensive). This creates a knowledge base conducive to rapid growth in international markets in which they have little or no previous experiential knowledge (Autio, Sapienza, & Almeida, 2000). In stable manufacturing industries, the additional costs of internationalisation can, however, put firms at a price disadvantage relative to their domestic and foreign competitors (Autio et al., 2000), thus having a detrimental impact on their sales (Miller & Shamsie, 1996).

For firms distant from London, lenders may be more likely to use 'hard' information such as annual reports and credit scores in evaluating their loan applications, rather than 'soft' information that may better inform the bank's understanding of the applicant's business model (Udell, 2015). For this reason, firms distant from London may have higher incentives to obtain higher credit scores. For such firms, the impact of international diversification on credit scores could be significantly lower. This is because such firms may employ alternative strategies to improve their credit scores, making the impact of international diversification alone insignificant.

Finally, there are two possible explanations for the finding on the impact of firm size on credit scores. First, SMEs could benefit from the advantages of economies of scale more than larger firms do (Loth & Parks, 2002). Second, larger firms are more likely to have higher credit scores than SMEs, making the impact of international diversification on their credit scores marginal.

5.1 Contributions and implications

The findings of this study offer several contributions and implications for the research on international diversification and firm performance. First, we have contributed to the extant literature on international diversification and firm performance by examining an understudied phenomenon of credit score, despite growing concern among investors regarding the creditworthiness of firms. Prior studies on international diversification and firm performance have provided contradictory findings: positive, negative, and even mixed effects of diversification on performance. These contradictory findings may suggest the presence of moderating variables. Thus, in this study, we introduced R&D intensity as a moderating variable to account for the contradictory findings of previous studies on the benefits of international diversification.

Second, we have supplemented the RBV logic with TCE and suggested that these theories are complementary in explaining the relationship between international diversification and firms' credit scores. In foreign markets, firms face particularly severe challenges in minimising transaction costs. By utilising internal resources – in this case R&D capabilities – firms can offset the costs and risks of operating in international markets and enhance their credit scores through diversification.

Third, the results of this study support the idea that firms benefit from the early efforts of international diversification, especially when the competition in the local market is high. These benefits, however, decrease with high levels of international diversification due to the increasing transaction costs (e.g., logistical costs) and information-processing demands. Although excessive R&D spend may lead to diminishing returns, it may nonetheless help to prop up credit scores.

This raises a fundamental problem: most theories incorporate many dimensions, and if one focuses on a specific sub-dimension of economic or organisational behaviour, it may be possible to prove at least some aspects of more than one theory 'right'. Moreover, as Kirca et al. (2011) argue, the deployment of multiple theories to understand the manifold dimensions of international diversification may make it challenging to contribute to the overall development and extension of the theory. Again, Hennart (2007) notes that if intangibles are controlled for, the relationship between international diversification and performance becomes less clear cut than it might otherwise seem. This might suggest that there may be a poor alignment between extrapolated theoretical predictions and the actual measurement of complex phenomena (Verbeke, Li, & Goerzen, 2009). TCE is really about the costs of organising interdependencies within the wider market versus within the firm (Hennart, 2007), which would suggest that a focus on more meso- or micro-level phenomena may be more appropriate than the broad aggregation undertaken in large-scale tests of TCE.

Again, the RBV logic tends to take significant account of unique organisational features, whereby the understanding of the wider condition can be viewed on quite an abstract or remote level. However, rather than too many theories, the problem may be that of too little theorising. Recent consolidations of theory – most notably the emerging theory of interconnectedness – have highlighted the complex interplay among physical and institutional environments, internal organisational dynamics, and firm-level outcomes. In this particular study, we have linked theories of internal organisational capabilities and advantages with theories that explicitly explore firms' interactions with others in the outside world, as well as investigated the extent to which each might influence creditworthiness, the former in terms of innovative capabilities and the latter in terms of the scale and scope of activities.

5.2   Limitations and future research

Our study is subject to limitations, which suggest further opportunities for future research. First, due to the limited availability of historical data on FAME credit scores, we were unable to examine the association between international diversification and annual changes in credit scores. A longitudinal examination would therefore be important to test whether our findings will hold over time, and hence advance our understanding of how international diversification affects credit score trends. Second, as with all econometric studies, this research might have been subject to omitted variable bias. Although the variables included in the models were carefully chosen, they were not comprehensive of all the

potential moderators of the relationship between international diversification and credit scores, such as the institutions in the host country wherein a firm diversifies its operations or the firm's age at entry (i.e., its first foreign sales). So further studies, which take these variables into account, will need to be undertaken. Third, in this study we did not fully capture the benefits and costs associated with international diversification, thus future studies could examine such issues. Finally, more studies are needed, which can take the home-host country context into account and explore diversification and its impact on credit scores. Such studies could also compare firms from different industries and countries, and examine their level of diversification, credit scores and performance.

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Table 1 Sample distribution by industry

Categories of industrial sectors	Freq.	Percent	Cum.
Agriculture, Forestry, and Fishing	231	3.52	3.52
Mining	248	3.78	7.31
Construction	418	6.37	13.68
Manufacturing	949	14.47	28.15
Transportation, Communications, and Utilities	906	13.82	41.97
Wholesale and Retail Trade	716	10.92	52.89
Services	3,054	46.58	99.47
Public Administration	35	0.53	100
Total	6,557	100	

This table presents the sample distribution by industry. Eight categories of industrial sectors are defined according to the Standard Industrial Classification (SIC) code.

Table 2 Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Q1	Median	Q3	Max	Skewness	Kurtosis
Credit_Score	6,557	0.78	0.226	0	0.68	0.88	0.92	0.99	-1.436	4.208
Int_Div	6,557	0.129	0.284	0	0	0	0.016	1	2.143	6.119
ROCE	6,557	0.17	0.387	-0.593	0	0.103	0.307	1.142	0.643	3.888
Sales_Growth	6,557	0.02	0.324	-0.768	-0.061	0.013	0.138	0.727	-0.314	4.132
NEG_EQTY	6,557	0.169	0.375	0	0	0	0	1	1.762	4.106
WC_TA	6,557	0.038	0.844	-5.054	-0.043	0.141	0.443	1	-3.736	21.133
LEV	6,557	0.382	0.556	-0.865	0.058	0.36	0.752	1.499	-0.075	2.944
AGE	6,557	2.72	0.867	0	2.197	2.773	3.296	4.7	-0.065	2.778
SME	6,557	0.602	0.49	0	0	1	1	1	-0.417	1.174
R&D_Intensity	6,557	0.274	1.432	0	0	0	0	10.389	6.005	39.563
Geographic_Locus	6,557	0.185	0.562	0	0	0	0	2	2.812	9.096

This table presents descriptive statistics for the variables in the empirical models. Credit_Score is the firm i's credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm i's foreign sales to total sales. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm i's sales from period t-1 to t. NEG_EQTY is a dummy variable, coded 1 if firm i's total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm i's net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm i's long-term debt to total assets. AGE is the natural logarithm of the number of years since firm i's founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. R&D_Intensity is the ratio of R&D expenditures to firm i's total assets. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions.

Table 3 Correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Credit_Score	1										
2. Int_Div	0.0695*	1									
3. ROCE	-0.0197	-0.0750*	1								
4. Sales_Growth	0.1198*	0.0082	0.0982*	1							
5. NEG_EQTY	-0.4116*	-0.0648*	-0.0138	-0.018	1						
6. WC_TA	0.3295*	0.0433*	-0.0384*	0.0285*	-0.5540*	1					
7. LEV	-0.3127*	-0.0452*	0.1787*	-0.0605*	0.2917*	-0.7039*	1				
8. AGE	0.2101*	0.1174*	-0.0197	-0.1139*	-0.2038*	0.1121*	-0.0201	1			
9. SME	-0.2258*	-0.0810*	0.0435*	-0.0736*	0.1720*	-0.0865*	0.1700*	-0.1924*	1		
10. R&D_Intensity	0.0327*	0.1566*	-0.0938*	0.0181	-0.0256*	0.0158	-0.0152	0.02	0.004	1	
11. Geographic_Locus	0.0756*	0.2265*	-0.0712*	0.0142	-0.0718*	0.0420*	-0.0474*	0.1574*	-0.1871*	0.1065*	1

This table presents the correlation coefficients between the variables in the empirical model. Credit_Score is the firm i's credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm i's foreign sales to total sales. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm i's sales from period t- 1 to t. NEG_EQTY is a dummy variable, coded 1 if firm i's total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm i's net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm i's long-term debt to total assets. AGE is the natural logarithm of the number of years since firm i's founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. R&D_Intensity is the ratio of R&D expenditures to firm *i*'s total assets. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions. * indicate statistical significance at p < 5% using two-sided t-statistics.

Table 4 International diversification, R&D Intensity, and credit scores

Variables	(1) Int_Div	(2) R&D×Int_Div	(3) R&D×Int_Div_SQ
Int_Div	0.125***	0.149***	0.127***
	(3.47)	(4.167)	(3.51)
Int_Div_SQ	-0.132***	-0.160***	-0.137***
	(-3.246)	(-3.934)	(-3.348)
R&D_Intensity		-0.042	-0.037
		(-1.015)	(-0.989)
Int_Div× R&D_Intensity		0.144*	
		(1.692)	
Int_Div_SQ× R&D_Intensity			0.188**
			(2.569)
ROCE	0.012	0.013*	0.012
	(1.643)	(1.714)	(1.623)
Sales_Growth	0.080***	0.082***	0.080***
	(10.106)	(10.287)	(10.109)
NEG_EQTY	-0.179***	-0.178***	-0.178***
	(-20.426)	(-20.320)	(-20.384)
WC_TA	0.017***	0.018***	0.018***
	(4.45)	(4.595)	(4.584)
LEV	-0.068***	-0.068***	-0.068***
	(-11.957)	(-12.047)	(-11.907)
AGE	0.031***	0.034***	0.031***
	(10.782)	(11.984)	(10.772)
SME	-0.048***	-0.049***	-0.048***
	(-9.193)	(-9.535)	(-9.217)
Geographic_Locus (Europe)[16]	-0.008	-0.008	-0.008
	(-0.477)	(-0.458)	(-0.458)
Geographic_Locus (Global)	-0.001	-0.003	-0.002
	(-0.164)	(-0.295)	(-0.173)
Intercept	0.765***	0.757***	0.765***
	(33.9)	(39.183)	(33.935)
Sample size	6,557	6,557	6,557
Adj. R-squared	0.26	0.256	0.261
F-test	148.28***	200.91***	134.35***
Industry fixed effects	Yes	Yes	Yes

Credit_Score is the firm i's credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm i's foreign sales to total sales. Int_Div_SQ is the squared percentage of firm i's foreign sales to total sales. R&D_Intensity is the ratio of R&D expenditures to firm i's total assets. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm i's sales from period t- 1 to t. NEG_EQTY is a dummy variable, coded 1 if firm i's total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm i's net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm i's long-term debt to total assets. AGE is the natural logarithm of the number of years since firm i's founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions. All continuous variables are winsorised at the 1st and 99th percentiles. Coefficients are unbracketed, with heteroscedastic robust t statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

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[16] *Domestic* is the reference category.

Table 5 Propensity score matching analysis.

Panel A: Pairwise difference in the mean credit score

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Credit_Score	Unmatched	82.14	76.94	5.20	0.69	7.54
	ATT	82.14	80.68	1.47	0.82	1.78

Panel B: Regression results using the propensity-score-matched sample

Variables	(1) Probit model	(2) PSM
Int_Div		0.086**
		(2.16)
Int_Div_SQ		-0.096**
		(-2.225)
ROCE	-0.457***	0.042***
	(-4.752)	(3.203)
Sales_Growth	0.202*	0.067***
	(1.819)	(5.159)
NEG_EQTY	-0.211*	-0.175***
	(-1.793)	(-10.911)
WC_TA	0.044	0.021***
	(0.791)	(2.962)
LEV	-0.048	-0.075***
	(-0.701)	(-7.321)
AGE	0.251***	0.038***
	(5.839)	(8.48)
SME	-0.111	-0.028***
	(-1.602)	(-3.439)
Geographic_Locus (Europe)	0.419*	-0.002
	(1.954)	(-0.079)
Geographic_Locus (Global)	1.241***	0.004
	(12.226)	(0.401)
Intercept	-2.410***	0.744***
	(-10.329)	(27.718)
Sample size	6,557	2,680
Pseudo R2/Adj. R-squared	0.103	0.229
Wald chi2/F-test	597.64***	44.12***
Industry fixed effects	Yes	Yes

This table presents the results of the one-to-one propensity score matching (PSM), which controls for sample selection based on all the control variables, namely ROCE, Sales_Growth, NEG_EQTY, WC_TA, LEV, AGE and SME, as well as the industry dummies. Panel A presents the pairwise differences between the mean credit scores of diversified and non-diversified firms in the propensity score matched samples. Panel B reports the results for the probit model and the baseline regression model using the matched samples. Our variable of interest is Credit_Score, the firm i's credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm i's foreign sales to total sales. Int_Div_SQ is the squared percentage of firm i's foreign sales to total sales. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm i's sales from period t- 1 to t. NEG_EQTY is a dummy variable, coded 1 if firm i's total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm i's net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm i's long-term debt to total assets. AGE is the natural logarithm of the number of years since firm i's founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions. All continuous variables are winsorised at the 1st and 99th percentiles. Coefficients are unbracketed, with heteroscedastic robust t statistics in parentheses.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 6 The impact of industry characteristics on the international diversification - credit scores relationship

Variables	(1)	(2)	(3)	(4)
	Competition effect			Industry effect
	High	Low	Services	Manufacturing
Int_Div	0.131**	0.106	0.159**	0.007
	(3.09)	(1.47)	(2.90)	(0.10)
Int_Div_SQ	-0.149**	-0.087	-0.191**	0.026
	(-3.06)	(-1.13)	(-3.03)	(0.36)
ROCE	0.008	0.022	0.013	0.014
	(0.90)	(1.49)	(1.33)	(0.58)
Sales_Growth	0.068**	0.131**	0.072**	0.088**
	(7.66)	(7.45)	(6.11)	(4.18)
NEG_EQTY	-0.190**	-0.143**	-0.190**	-0.184**
	(-18.87)	(-8.27)	(-15.15)	(-6.67)
WC_TA	0.020**	0.010	0.012*	0.018
	(4.23)	(1.44)	(2.21)	(1.22)
LEV	-0.061**	-0.084**	-0.078**	-0.056**
	(-9.09)	(-7.89)	(-9.18)	(-2.99)
AGE	0.031**	0.030**	0.037**	0.037**
	(9.25)	(5.32)	(7.62)	(5.30)
SME	-0.042**	-0.059**	-0.057**	-0.030*
	(-7.17)	(-5.49)	(-7.51)	(-2.38)
Geographic_Locus (Europe)	-0.015	0.000	0.018	-0.023
	(-0.71)	(0.01)	(0.75)	(-0.56)
Geographic_Locus (Global)	0.007	-0.026	0.017	-0.032*
	(0.65)	(-1.44)	(1.19)	(-1.82)
Intercept	0.790**	0.780**	0.760**	0.770**
	(23.81)	(38.12)	(51.18)	(30.01)
Sample size	4,996	1,561	3,054	949
Adj. R-squared	0.262	0.275	0.264	0.210
F-test	124.37***	44.47***	123.32***	21.39***
Industry fixed effects	-	-	-	-

Credit_Score is the firm i's credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm i's foreign sales to total sales. Int_Div_SQ is the squared percentage of firm i's foreign sales to total sales. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm i's sales from period t- 1 to t. NEG_EQTY is a dummy variable, coded 1 if firm i's total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm i's net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm i's long-term debt to total assets. AGE is the natural logarithm of the number of years since firm i's founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions. All continuous variables are winsorised at the 1st and 99th percentiles. Coefficients are unbracketed, with heteroscedastic robust t statistics in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 7 The impact of distance from London and size on the international diversification – credit scores relationship

Variables	(1)	(2)	(3)	(4)	(5)
			Distance effect		Size effect
	Close	Distant	Distance from London	SMEs	Large
Int_Div	0.146**	0.040	0.120**	0.176**	0.062
	(3.47)	(0.60)	(3.32)	(3.36)	(1.27)
Int_Div_SQ	-0.153**	-0.043	-0.126**	-0.185**	-0.066
	(-3.23)	(-0.59)	(-3.09)	(-3.12)	(-1.20)
LN_Distance			0.005**		
			(4.21)		
ROCE	0.020*	-0.016	0.013*	0.003	0.042**
	(2.39)	(-1.02)	(1.76)	(0.32)	(3.02)
Sales_Growth	0.080**	0.085**	0.081**	0.088**	0.062**
	(8.73)	(5.38)	(10.18)	(8.74)	(4.98)
NEG_EQTY	-0.173**	-0.192**	-0.178**	-0.165**	-0.215**
	(-17.43)	(-10.71)	(-20.36)	(-16.43)	(-12.36)
WC_TA	0.019**	0.009	0.017**	0.019**	0.021*
	(4.43)	(1.00)	(4.39)	(4.35)	(1.77)
LEV	-0.070**	-0.065**	-0.069**	-0.065**	-0.079**
	(-10.71)	(-5.84)	(-12.14)	(-8.89)	(-8.97)
AGE	0.034**	0.024**	0.030**	0.038**	0.024**
	(10.07)	(4.19)	(10.24)	(8.56)	(6.52)
SME	-0.054**	-0.026*	-0.047**		
	(-9.00)	(-2.55)	(-9.17)		
Geographic_Locus (Europe)	0.004	-0.033	-0.008	0.012	-0.015
	(0.18)	(-0.91)	(-0.45)	(0.38)	(-0.73)
Geographic_Locus (Global)	-0.000	-0.003	0.000	-0.001	0.001
	(-0.01)	(-0.17)	(0.05)	(-0.04)	(0.06)
Intercept	0.774**	0.775**	0.763**	0.693**	0.826**
	(50.02)	(21.57)	(52.06)	(35.96)	(43.93)
Sample size	5,128	1,429	6,557	3,948	2,609
Adj. R-squared	0.259	0.279	0.262	0.235	0.201
F-test	120.84***	32.84***	141.72***	88.70***	25.49***
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

Credit_Score is the firm *i*'s credit score as developed by FAME, capturing the likelihood of a business becoming insolvent over a period of 12 months. Int_Div is the percentage of firm *i*'s foreign sales to total sales. Int_Div_SQ is the squared percentage of firm *i*'s foreign sales to total sales. ROCE is the ratio of profit before tax to capital employed. Sales_Growth is the percentage change in firm *i*'s sales from period t- 1 to t. NEG_EQTY is a dummy variable, coded 1 if firm *i*'s total liabilities exceed the book value of its total assets, and 0 otherwise. WC_TA is the ratio of firm *i*'s net working capital (measured as current assets minus current liabilities) to total assets. LEV is the ratio of firm *i*'s long-term debt to total assets. AGE is the natural logarithm of the number of years since firm *i*'s founding year. SME is a dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise. LN_Distance is the natural logarithm of the driving distance between the headquarters of the firm in the postcode area and the centre of London, using the road network measured in miles. Geogrpahic_Locus is the geographical locus in which firms' international activities are carried out. See Appendix I for all variable definitions. All continuous variables are winsorised at the 1st and 99th percentiles. Coefficients are unbracketed, with heteroscedastic robust t statistics in parentheses.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Dependent variable

Credit_Score	The credit scores as developed by the Financial Analysis Made Easy (FAME), capturing the likelihood of a business becoming insolvent over a period of 12 months. Scores range from 0 to 100, with lower scores indicating a greater probability of default risk.

Main variables

Int_Div	The percentage of firm's foreign sales to total sales.
Int_Div_SQ	The squared percentage of firm's foreign sales to total sales.

Firm-level controls

ROCE	The firm's ratio of profit before tax to capital employed.
Sales_Growth	The percentage change in firm's sales from period t-1 to t.
WC_TA	The ratio of firm's net working capital (measured as current assets minus current liabilities) to total assets.
LEV	The ratio of firm's long-term debt to total assets.
AGE	The natural logarithm of the number of years since firm's founding year.
NEG_EQTY	A dummy variable, coded 1 if a firm's total liabilities exceed the book value of its total assets, and 0 otherwise.
SME	A dummy variable, coded 1 if firm is classified as a small- and medium-sized enterprise by the FAME, and 0 otherwise.

Additional variables

R&D_Intensity	The ratio of research and development expenditures to firm's total assets.
HHI	HHI is the Herfindahl-Hirschman index (HHI), which is a measure of market concentration. The HHI is computed by summing the squared market shares of all firms competing in an industry. A firm's market share is given as a ratio of the firm's sales to total sales in its industry. The HHI can range from close to zero to 10,000 with higher values of this index indicate greater industry concentration.
LN_Distance	The natural logarithm of the driving distance between the headquarters of the firm in the postcode area and the centre of London, using the road network measured in miles
Geographic_Locus	A regional classification variable (ranging from domestic to global), which captures the geographic locus in which firms' international activities are carried out.

Appendix II: Post-hoc Test
Panel A: Descriptive statistics for each distance groups (Distant vs Close)

Cluster	Obs	Mean	Std. Dev.	Std. Error	Min	Max
Close	5,128	77.34	23.12	0.32	0	99
Distant	1,429	80.40	20.55	0.54	0	99
Total	6,557	78.01	22.62	0.28	0	99

Panel B: Tukey Simultaneous Tests for Differences of Means

Difference of levels	Difference of Means	SE of Difference	95% Confidence Interval		T-Value	Adjusted P-Value
			Lower Bound	Upper Bound		
Distant – Close	3.06	0.68	1.74	4.39	4.53	0.000